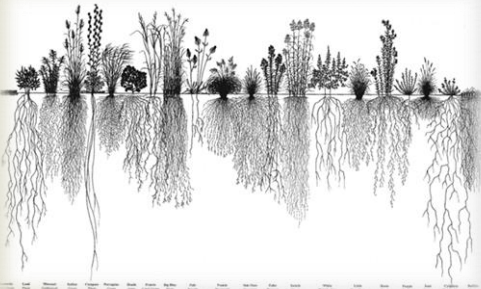


## Soil Synergy

A diversity of living roots throughout the year provides habitat for soil biota and maintains the soil food web (SFW).



Clay particles have a negative ionic charge.



"Clay Domains" is a stack of parallel clay particles, held by ionic bonding & associated with humic substances.

"Humic Substances" are made by a process called humification (soil, water, biochemical and chemical reactions).

## Chemical

- Photosynthesis relies on water and nutrient availability which are indirectly affected by soil microbial activities.
- Root exudates are the main source of food for soil organisms.
- Increased soil humus-clay complexes enhances:
  - Nutrient adsorption & retention.
  - The ability to hold more moisture in micro pores.
  - Cation Exchange Capacity (CEC).

The biological component has the most influence on the chemical and physical components of soil synergy.

Why do we need to connect the biological, chemical and physical rings?

## Biological

Soils are alive! The variety of soil organisms (bacteria, fungi, micro arthropods, nematodes, earthworm and insects) live in the soil. They perform a number of vital processes, such as nutrient cycling, etc.

- Increases binding of soil particles (with microbial glues like Glomalin) to become macro aggregates.
- Enhances transformation of nutrients to other usable forms by both plant and other trophic levels.
- Microbial diversity minimizes disease in plants (predator/prey relationships).
- Degradation of toxic substances in soil.
- Increment of porosity in the soil improving water infiltration and aeration.
- Enhances nutrient cycling.
- Optimizes conversion of exudates to energy and microbial growth.
- Allows the soil to function at a higher level.

## Biological:

Keep a cover over the soil surface and minimize soil disturbance. Integrate grazing if possible.



All trophic levels must be working for the "Soil Food Web (SFW)" to function, including plant shoots and roots.

## Chemical

The elements or chemical compounds that are present (Ca, Mg, K, Na, Cu, Al, H,  $H_2PO_4$ ,  $NH_4$ ,  $HPO_4$ ,  $SO_4$  and others) in the soil/clay domains are transformed by microbes and then taken up by plants. Microbes are essential for nutrient cycling.

## Soil Synergy

## Physical

Soil physical properties (porosity, infiltration, aggregation, texture) affect soil fertility by altering water movement, root penetration, and aeration. The ionic charge of clay domains can hold a variety of soil cations. Biologically created humic substances can retain ions and molecules on their surface and within their structures.

## Physical

- Sand, Silt and Clay make up texture of the soil.
- Water stable aggregation influenced by a biological will enhance the ability to function at a higher level.
- Water infiltration and water holding capacity improve.
- Reduction of soil and water erosion.
- Enhanced water holding capacity
- Optimization of nutrient cycling.
- Improves  $CO_2$  and  $O_2$  exchange in the soil.

**OBJECTIVE:** A healthy soil is the result of a "Soil Health Management System" which promotes synergy among Biological, Chemical and Physical processes.

Ref: Cornell Soil Health Assessment Training Manual 2<sup>nd</sup> Edition (2009)



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Clarence Chavez 7/2014